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RESEARCH MANAGEMENT DIVISION
REVIEW
FOR THE FISCAL YEAR 1985/86

RESEARCH MANAGEMENT DIVISION
Alberta Environment

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RESEARCH MANAGEMENT DIVISION
REVIEW
FOR THE FISCAL YEAR 1985/86

RESEARCH MANAGEMENT DIVISION
Alberta Environment

RMD Report 87/39

1987

TABLE OF CONTENTS

Page

INTRODUCTION 1
    Divisional Organization 1
    Report Organization 3

ADMINISTRATION 4
    Projects 5

ACID DEPOSITION RESEARCH PROGRAM 7
    Projects 8
    Publications 13

AIR QUALITY/CLIMATE RESEARCH PROGRAM 14
    Projects 15
    Committees 17

ENVIRONMENTAL CONTAMINANTS RESEARCH PROGRAM 18
    Projects 20
    Publications 23
    Committees 24

ENVIRONMENTAL EMERGENCIES AND RISK ASSESSMENT RESEARCH PROGRAM 25

ENVIRONMENTAL INFORMATION RESEARCH PROGRAM 26
    Publications 27
    Committees 28

GEOSCIENCE RESEARCH PROGRAM 29
    Projects 30
    Committees 32

RECLAMATION RESEARCH PROGRAM 33
    Projects 34
    Publications 38
    Committees 39

WATER RESOURCES RESEARCH PROGRAM 40
    Projects 41

WATER TREATMENT AND WASTE MANAGEMENT RESEARCH PROGRAM 44
    Projects 46
    Publications 52
    Committees 54

INTRODUCTION

The objectives of the Research Management Division (RMD) are:

1. To provide timely and authoritative scientific and technical information to other operational divisions within Alberta Environment;
2. To plan and co-ordinate the scientific environmental research planning requirements of the department; and
3. To publish research on environmental matters that are pertinent to departmental and provincial needs.

To realize these objectives, the Research Management Division aids in the co-ordination of all the department's environmental research and ensures that the available research dollars are well spent on activities that respond to priority needs. To this end, RMD acts as a co-ordinator for research carried out on behalf of the department at the Alberta Environmental Centre in Vegreville. As well, divisional staff contantly interact with other line divisions of Alberta Environment to keep their programs current and of direct applicability to the department.

In its research management capacity, the Research Management Division actively manages or oversees a number of environmental research projects. Proposals for projects are solicited by RMD as needs are identified and terms of reference developed. However, unsolicited proposals may be submitted through other divisions of Alberta Environment or directly to RMD. All are reviewed in the light of departmental objectives and program requirements.

Divisional Organization

The division combines diverse skills such as project management, budgeting and financial control, contracting, and publication editing with comprehensive knowledge in many scientific areas pertinent to environmental research. The division's expertise, which allows for a comprehensive approach to environmental problem solving, is drawn from such fields as hydrology, climatology, pedology, biology, meteorology, ecology, and sociology.

The organizational structure of RMD merges a functional management role of four scientific systems or working groups (human, air, terrestrial, and aquatic), into a matrix of well-defined scientific research programs. The advantage of this structure is the flexibility of an interdisciplinary approach to environmental research. For example, the division's work in the area of acid deposition involves research on the complex interface between the atmosphere and biosphere, or in other words, how atmospheric pollutants affect soils and vegetation.

During the 1985/86 fiscal year, the division's research programs were:

1. Acid Deposition;
2. Air Quality/Climate;
3. Environmental Contaminants;
4. Environmental Emergencies and Risk Assessment;
5. Environmental Information;
6. Geoscience;
7. Reclamation;
8. Water Treatment and Waste Treatment; and
9. Water Resources.

Each is defined by a comprehensive descriptive document that is updated regularly to keep pace with current objectives. Budget funds are allocated to each of the programs on the basis of priorities determined by Alberta Environment. Environmental concerns in Alberta are continually examined and incorporated into the division's active programs.

A large portion of staff time is allocated to the departmental, interdepartmental, and interagency committees that co-ordinate research programs. The division was represented on 48 committees, 13 being departmental committees, and the remainder interagency or interdepartmental committees such as the Reclamation Research Technical Advisory Committee (RRTAC) and the Federal/Provincial Long-Range Transport of Atmospheric Pollutants (LRTAP) committees. Involvement in these committees has enhanced the effectiveness of the division and its management capabilities, and has ensured that the professional staff have maintained an awareness of current environmental research activities in Alberta and elsewhere.

To further the division's expertise, RMD staff also attended and presented papers at scientific conferences and meetings in a variety of locations in Canada and the United States. In addition, they sponsored workshops and seminars on various research topics.

Report Organization

This report is based on the broad programs noted earlier in the introduction. Some specific references may be made either to location or to systems where appropriate. Projects that fall under AOSERP have been incorporated into the descriptions of the other programs.

ADMINISTRATION

The projects identified in this section are contracts entered into for administration purposes only. These contracts cover the following areas:

1. Alberta Environmental Research Trust Grant;
2. Catering for the Mildred Lake Research Facility;
3. Outside (non-government) review of research reports; and
4. Support for visiting scientists in the Zoology seminar series.

PROJECTS

Alberta Environmental Research Trust

The Alberta Environmental Research Trust (AERT) was created in the spring of 1971 by enactment of the Legislative Assembly of Alberta to provide a mechanism for the expansion of applied and fundamental research and development relative to environmental improvement. Practical projects relevant to Alberta are encouraged. Practical projects relevant to Alberta are encouraged. AERT should be considered as a source of funds for research that would otherwise not be funded by industry, university, or government departments.

A Grants Advisory Committee is appointed by the Board of Trustees to review research proposals and offer scientific advice. This committee consists of specialists in various fields who are chosen for their understanding of specific environmental problems, and includes two representatives from RMD.

Contractor: Alberta Environmental Research Trust (AERT)
Funding: $340 000.00

Mildred Lake Camp Catering

To support AOSERP research, the Research Management Division operates the Mildred Lake Research Facility for project and scientific staff working in the Athabasca oil sands area.

The Mildred Lake Scientific Research Facility is situated near Mildred Lake, approximately 31 miles north on Highway 63 from Fort McMurray, Alberta.

This contract provides for the catering service for the camp, preparing and serving food for a minimum of seven persons and a maximum of 60 persons.

This project is an integral component of the Alberta Oil Sands Environmental Research Program (AOSERP).

Contractor: Mr. John Merrick, Bull Caterers Ltd.
Funding: $116 434.85

Review and Comment on a Report Entitled "An Analysis of Benthic Invertebrate and Water Quality Monitoring Data in the Athabasca River"

This project provided for an outside review and comment on the above-mentioned report. The contractor has considerable expertise in limnological investigations and provided an invaluable scientific review of the report.

Contractor: Linda Corkum
Funding: $500.00

Visiting Speakers: Zoology Seminar Series

This contract is providing financial support in the form of travel and accommodation costs for visiting speakers, who will present seminars at the University of Alberta and Alberta Environment. The invited speakers are all experts in their field and may address topics in the areas of hydrology, hydrochemistry, limnology, and geosciences. These seminars assist department staff to keep abreast of current scientific developments.

Contractor: Dr. E. Prepas, Department of Zoology, University of Alberta
Funding: $2 500.00

ACID DEPOSITION RESEARCH PROGRAM

The Acid Deposition Research Program (ADRP) is designed to plan and implement research specific to Alberta on the environmental impact, and on the medium- to long-range transport of acid-forming emissions. The program addresses the following objectives:

1. To characterize sensitive environmental ecosystems and develop methodologies to identify and/or predict measurable short-, medium-, and long-term effects of acidic or acidifying substances on Alberta ecosystems;
2. To determine the characteristics and quantities of both long-range emissions and those generated locally, and to examine their effects on the environment;
3. To develop a basis and approach for preventive strategies and environmental protection; and
4. To co-ordinate departmental research on acid deposition with other private and public agencies in Alberta and the rest of Western Canada.

The research will provide information that will help Albertans understand the potential effects of acid-forming emissions on soil, vegetation, aquatic systems, and human health. The results will be used to evaluate and refine Alberta's air quality standards; to develop regulatory and control strategies to minimize or prevent environmental damage due to acid deposition; and to help plan provincial industrial development.

PROJECTS

Target Loading Criteria for Western Canada

The emissions of acid-forming substances into the atmosphere, their deposition and subsequent impact on environmental ecosystems are of significant concern. The current target loading of 20 kg/ha/yr is for the wet deposition of sulphate on moderately sensitive aquatic ecosystems in eastern Canada. The loading specified may not be applicable for western Canada's environmental and ecological conditions. Further, in western Canada, dry deposition is considered to be as important as wet deposition. However, at present there are no target loading criteria for total acid deposition (wet and dryfall). This project will ascertain the applicability of the target loading concept to western Canada, assess the adequacy of existing data bases, and make recommendations for establishing requisite monitoring programs for determining target loadings. This project will ultimately determine specific target loading criteria for total acid deposition (wet and dryfall) for environmental conditions and ecosystems of western Canada.

The information obtained from the program will be used to assess western Canada's air quality standards, emission guidelines and regulatory controls with respect to protecting citizens and the environment from the effects of acid deposition.

Contractor: Committee on Scientific Criteria for Environmental Quality,
National Research Council of Canada

Funding: $10 000.00 (Research Management Division, Alberta Environment)
10 000.00 (Saskatchewan Environment)
10 000.00 (Manitoba Environment)
10 000.00 (British Columbia Environment)
12 250.00 (Environment Canada)

Sulphation Plate Network in the Athabasca Oil Sands Region

The acid deposition effects research program in the oil sands region is designed to address the question - is there measurable environmental damage due to acidification which can be monitored over the medium and long term. If ecosystem damage is occurring, the hypothesis is that the pollutant loading and some quantitative measurement of damage will vary significantly among low, medium, and high plume impingement zones. To quantify concentration levels of SO_2 in the oil sands and delineate regions of low, medium, and high plume impingement, co-located pairs of 3" sulphation plates were deployed at approximately 65 sites within a 25 km radius of the two oil sands plants. The plates were exposed and analyzed for each month from May to September. The objectives of the study were: (1) to evaluate the intrasite variability of the reactivity of lead dioxide (PbO_2); (2) to evaluate the suitability of sulphation plates for quantifying atmospheric SO_2 concentrations and qualitatively determining spatial deposition patterns; and (3) to compare the spatial pattern derived from the sulphation plate network with that delineated by the atmospheric dispersion model, FREDIS.

Contractor: CHEMEX Labs (Alberta) Ltd.
Funding: $6 000.00

Air Quality Data Acquisition - Sandalta Air Quality Trailer

The emission of acid-forming substances into the atmosphere and their deposition and subsequent impact on the ecosystem are of current concern. As the magnitude and intensity of deposition follows an episodic pattern, the response of vegetation to pollution episodes is dependent upon the relationship and timing of the episode and the physiological development of the receptor. Therefore, air quality/atmospheric data must be interfaced with receptor-response measurements.

To facilite the implementation of a biomonitoring research program, an air quality monitoring station was established in the vicinity of a permanent sample plot on the Sandalta lease in the oil sands area. The station continuously measures meteorological data and ambient concentrations of acid-forming gases. Data generated will be used to develop numerical models for interfacing atmospheric/air quality data to plant response measurement. Annual reports are available from the Research Management Division.

Contractor: Western Research, Division of Bow Valley Resources Services Ltd.
Funding: $79 560.00

Quantification of Winter Pollutant Deposition in the Athabasca Oil Sands Region

The total pollutant loading of the winter snowpack is an accumulation of atmospheric pollutants scavenged from the air by snow (i.e., wet deposition) and deposited directly unto the snowpack (i.e., dry deposition). The accumulated snowpack in the Athabasca oil sands region has been extensively sampled and chemically analyzed since 1976. The objectives of the project are to quantify the total ionic and particulate loading of the snowpack and to qualitatively assess the spatial distribution of pollutant deposition resulting from industrial source emissions in the area. Samples were collected at 60 sites in the oil sands area in accordance with Alberta Environment's quality assurance standards. This information will provide the baseline data required to assess the impact of future industrial developments in the area on the input of atmospheric pollutants into sensitive ecosystems.

The snow sampling sites were also characterized and evaluated to assess the suitability of the network with respect to the representativeness of the sampling sites and adherence to accepted siting criteria.

Contractor: ENTECH Management and Scientific Services Ltd.
CHEMEX Labs (Alberta) Ltd.
Funding: $35 000.00

Atmosphere-Biosphere Interface: Application of a Numerical Model to Assess Growth Response of Jackpine to Chronic Atmospheric SO_2 Exposures

Plant response to chronic pollutant exposure is of primary importance in any investigation of natural ecosystems. A multivariate non-linear regression model has been developed by Dr. Nosal to explain the relationship between the growth response of soybean and annual basal area increment of lodegpole pine to ambient chronic atmospheric sulphur dioxide (SO_2) exposures. The main objective of this project was to apply the model to the historical (modelled) air quality data base in the AOSERP area to assess the response of annual radial increment of jackpine to chronic atmospheric SO_2 exposure. The project was completed in 1986.

Contractor: Dr. Miloslav Nosal, Statscon Statistical Consulting Co.
Funding: $10 000.00

Effects of Deposition of Acid-Forming Substances on Organic Matter Decompositon/Nutrient Cycling in a Forest Ecosystem

This project is part of the ecological monitoring research in the AOSERP area. This study examines nutrient cycling and organic matter decomposition as influenced by acidic deposition. Scientific literature suggests that soil acidification can retard organic matter decomposition through changes in soil microbial activities. This effect, in turn, can influence nutrient release and availability for higher plants. In addition, soil acidification is known to increase the leaching of key elements required for plant growth.

Contractor: Dr. D. Parkinson, Kananaskis Centre for Environmental Research, University of Calgary

Funding: $6 455.00

Government/Industry Acid Deposition Research Program - Biophysical Research

The Alberta Government/Industry Acid Deposition Research Program is an $8 million project of Alberta Environment, the petroleum industry, the Energy Resources Conservation Board, and the electrical utilities designed to assess the effects of acid-forming gases on the environment and human health. The biophysical research concentrates primarily on agricultural areas in the southern part of the province. The first critical phase of the biophysical program involves:

1. A characterization and quantification of local and regional air quality;
2. An assessment of the potential impact of air quality on the environment;
3. An inventory of sulphur oxide and nitrogen oxide emissions in Alberta; and
4. A world literature review on the effects of acid deposition on vegetation, soils, and surface and groundwaters.

Contractor: Kananaskis Centre for Environmental Research (KCER)

Funding: $500 000.00 Alberta Environment (Research Management Division)
$500 000.00 Petroleum Industry, Electrical Utilities, and the Energy Resources Conservation Board

1985 Joint Annual Meeting of the Canadian Prairie and Northern Section (CPANS) and the Pacific Northwest International Section (PNWIS) of the Air Pollution Control Association (APCA), Calgary, Alberta, 1985 November 13-15

The annual technical meetings of PNWIS/APCA are a forum for the presentation and discussion of issues related to air pollution. The theme for the November 1985 meeting was **The Impact of Air Toxics on the Quality of Life** which reflected the increasing emphasis on effects of air quality on human health. International representation from government, industry, the academic community, and the private sector convened to discuss and exchange information on current and future air pollution issues.

Contractor:	Canadian Prairie and Northern Section of the Air Pollution Control Association
Funding:	\$ 3 000.00 Research Management Division
	\$34 000.00 Environment Canada, Energy Resources Conservation Board, and industry

PUBLICATIONS

Nosal, M. 1984. Atmosphere-biosphere interface: probability analysis and an experimental design for studies of air pollutant-induced plant response. Prep. for Alberta Environment, Research Management Division, by Statistical Research Laboratory, University of Calgary. RMD Report 84/25. 98 pp.

AIR QUALITY/CLIMATE RESEARCH PROGRAM

Pollutant emissions and their secondary or tertiary reaction products are important contributors to the degradation of air quality. In recent public surveys, air quality was identified as a leading environmental concern in Alberta; the issue ranked fourth in 1981 and first in 1982 and 1983. The objectives of the air quality sub-program are to characterize and quantify atmospheric pollutants and delineate their effects on air quality, the environment, and climate. Research priorities, at this time, are focussed on flaring, urban air quality, and fugitive and uncontrolled emissions. Research results will be used to determine the best possible management strategies and regulatory controls to prevent or mitigate degradation of air quality.

The impacts of climate change and increased climate variability have become more widely recognized. The potential ramifications of such aberrations for Alberta are not fully known. The climate sub-program will address the impacts of climate variability on the management and development of Alberta's economic and human resources. Program direction is determined by an interagency/interdepartmental committee, chaired by the Research Management Division, with representation from the Alberta government departments of Environment, Agriculture, and Forestry, Lands and Wildlife; Environment Canada; Alberta Research Council; Canadian Petroleum Association; universities; and the Alberta Climatological Association. Recommendations from the sub-program will be used to develop and implement strategic plans to minimize the potentially adverse impacts and maximize the positive impacts of climate variability. The sub-program will complement the Canadian Climate Program as recommended by the Canadian Council of Resource and Environment Ministers.

PROJECTS

Effect of Urban Air Quality on Visibility

Urban air quality has been identified, in recent public surveys, as a leading environmental concern. In urban areas, atmospheric pollution generates secondary pollutants through radiation mediated photochemistry. Fine particulate aerosols act as optical filters resulting in regional scale haze and reduced visibility.

Previous studies have indicated that the potential for serious pollution problems exists in both Calgary and Edmonton. The efficient management of urban air resources and the planning and design of environmental legislation, impact assessments, and land use planning requires a comprehensive air quality assessment. The primary objectives of the research are to develop and design a detailed, comprehensive research and monitoring protocol to:

1. Characterize and quantify the temporal and spatial variations in the chemical and physical properties of urban aerosols;
2. Determine the relationship between visibility and particle mass loading; and
3. Assess the effects on radiation and energy budgets of urban areas.

Contractor: Atmospheric Sciences Department, Alberta Research Council
Funding: $39 973.00 (Research Management Division, Alberta Environment)
$19 987.00 (Alberta Research Council)

Derivation of Storm Intensity Duration Curves from AES Radars

The ability to generate storm intensity/duration curves from radar imagery will assist in the early and quick assessment of a storm's location, duration and severity and the potential damage it may cause. This has not been possible in the past as curves were produced from a sparse network of tipping bucket rain gauges which resulted in a high degree of uncertainty in the analysis. It would be very expensive to install and maintain a sufficient network density to provide the precise measurements required.

This is an extension of a research project which derived storm density duration curves from the ARC radar at Penhold. Accumulated radar reflectivity data were converted to accumulated rainfall which was used to generate isohyetal maps of areal rainfall intensity.

Environment Canada has recently established two weather radars at Carvel and Vulcan. As the radar imagery data are transmitted in a different format than the ARC radar, this project will investigate the feasibility of converting this imagery to storm intensity/duration curves. Computer software will be developed to interpret rainfall intensities from several storms and establish empirical relationships in order to produce storm intensity/duration maps. The methodology developed by this project will provide an economical and expeditious means of analysing severe storms and the extent of their damage in Alberta.

Contractor: Atmospheric Sciences Department, Alberta Research Council
Funding: $15 000.00

Stack Aerodynamic Downwash

Low flow rates in industrial stacks emitting air pollutants leads to a situation where the plume is pulled down behind the stack. This reduced plume rise causes higher ground level concentrations of pollutants. The sour gas industry is currently experiencing low flows either because of low production rates or incinerator temperature reductions for fuel gas savings. There is a paucity of information and ongoing research on stack aerodynamic downwash. Preliminary investigations have demonstrated the need for more intensive field observations. The objective of this project is to study, at selected gas plants, the stack downwash phenomena of incinerator stack plumes for a variety of environmental and stack design conditions.

Contractor: Monenco Consultants Limited
Funding: $30 000.00 (The project was cancelled due to prevailing warm temperatures which precluded the successful execution of the field work).

COMMITTEES

Departmental

Departmental Committee on Acid Deposition

Acid Deposition Program Planning Committee

Air Quality/Climate Program Planning Committee

Interagency/Interdepartmental

Alberta Climate Advisory Committee (Alberta Environment)

Alberta Environmental Centre Technical Advisory Committee (AEC/TAC)

Alberta Government/Industry Acid Deposition Research Program (AGIADRP), Executive Committee

Alberta Government/Industry Acid Deposition Research Program (AGIADRP), Members Committee

Associate Committee on Scientific Criteria for Environmental Quality (National Research Council)

Atmospheric Sciences Program Subcommittee (Alberta Research Council)

Canadian Climate Program Planning Board (Environment Canada)

Olympic Secretariat Climate Advisory Committee (Alberta Recreation and Parks)

Federal/Provincial Long-Range Transport of Atmospheric Pollutants (LRTAP), Acid Rain Steering Committee (Environment Canada)

Federal/Provincial Long-Range Transport of Atmospheric Pollutants (LRTAP), Acid Rain Research and Monitoring Coordinating Committee (RMCC), Atmospheric Sciences Group (Environment Canada)

Western and Northern Canada Long-Range Transport of Air Pollutants (W&NC-LRTAP), Technical Committee (British Columbia, Alberta, Saskatchewan, Manitoba, Northwest Territories, and Canada)

Second Symposium/Workshop on Acid Forming Emissions in Alberta and Their Ecological Effects Steering Committee (Alberta Environment, University of Calgary, Energy Resources Conservation Board, Canadian Petroleum Association) Government/Industry Consultative Committee on Flaring

ENVIRONMENTAL CONTAMINANTS RESEARCH PROGRAM

Contaminants impact the environment through industrial discharges, spills, spraying programs and natural releases. These released substances pose a substantial presence or potential hazard to human health or living organisms because such wastes are lethal, non-degradable, and/or persistent in nature. These products also may be biologically magnified, or may otherwise cause or tend to cause detrimental cumulative effects.

The main objective of the contaminant program is to plan, design, and implement research in order to support operating divisions for standards and guidelines criteria, contaminants control, environmental monitoring, and decision making. The specific program objectives are:

1. To develop a mechanism to set priorities and to identify contaminants of concern within the province of Alberta;
2. To develop routine monitoring guidelines in order to determine short- and/or long-term trends in environmental quality;
3. To characterize sensitive environmental components and to develop mechanisms to identify and/or predict environmental deterioration caused by contaminants in Alberta;
4. To develop a mechanism whereby information relative to the fate and effect of contaminants can be generated and from which mitigative actions and decisions can be directed;
5. To develop a scientific basis and approach for preventative strategies and environmental protection taking into account socio-economic factors; and
6. To provide support for the co-ordination and integration of research and monitoring activities with other departments, governments, industry, and agencies.

Major issues surrounding environmental contaminants are of concern to both public and scientific communities. The public is concerned about the release of contaminants into the ecosystem from various industrial practices and landfill activities. They also question the effectiveness and rationale of current standards. Issues on human health and environmental consequences are subject to much debate and skepticism. Present analytical techniques are identifying compounds at lower and lower concentrations while our understanding of the effects of these compounds is generally not known or poorly understood. The scientific community concerns are aimed at developing standards that would be acceptable and safe to the public and renewable resources and the development of new methodology and equipment to upgrade analytical state-of-the-art technology.

PROJECTS

Aquatic Fate of Fish Tainting Compounds in the Athabasca River

This study investigated the relationship between certain hydrocarbons that are present naturally, or could be introduced due to surface oil sands mining and upgrading activities, and their potential bioaccumulation and tainting of the commercial and sports fisheries in the Athabasca River. This included the definition of contaminants of concern, reviewing of their bioavailability and bioconcentration properties and consideration of their persistence in the aquatic environment of the Athabasca River. A water management approach for setting ambient surface water objectives and effluent standards for fish tainting compounds was discussed within the context of basin wide water resources planning.

Contractor:	HydroQual Consultants Inc. and Dominion Ecological Consulting Ltd.
Funding:	$28 700.00

An Investigation into Biological Control Agents for Aquatic Plant Management in Irrigation Systems

Overabundant aquatic vegetation in irrigation channels results in reduced water use efficiency and increased operation costs. In order to ensure that sufficient water is available for irrigation, structural, mechanical, and chemical methods are utilized to control aquatic vegetation to acceptable levels. Both structural and mechanical methods are very expensive and have limited application. Although chemical treatments result in rapid plant reduction, the control is temporary and the chemicals are toxic to other aquatic life and wildlife. This project consisted of a literature review to determine which, if any, aquatic plant biological control agents could be utilized for integrated plant management in Southern Alberta. It also identified information gaps where research might be required to assess the suitability of potential candidates.

Contractor:	Dr. E.A.D. Allen
Funding:	$5 000.00

1985 Black Fly Control: Fish Toxicological Studies on the Athabasca River

In situ studies have been conducted to assess if mortality/ moribidity occurred in native larval fish exposed to field concentrations of methoxychlor applied to the Athabasca River. This research provided knowledge for the enhancement of environmental protection through proper use and management of pesticides. This project also included laboratory analyses and fish toxicological studies that were carried out at the Alberta Environmental Centre (AEC) in Vegreville, Alberta.

Contractor:	Mr. R.B. Murray, Treval Environmental Applications Ltd. Dr. Jim Moss, Alberta Environmental Centre (AEC) Dr. D. Smillie, Alberta Environmental Centre (AEC)
Funding:	$40 000.00

The Persistence and Movement of Contaminants from Heavy Oil Recovery

Various methods utilized in Alberta for the recovery of heavy oils and bitumen generate or concentrate organic compounds which are toxic or otherwise biologically active. Should these materials enter the environment they may produce adverse biological effects. The effects will depend on the movement, accumulation, and persistence of compounds in various environmental compartments.

The term 'fugacity' has been used to describe the tendency of a chemical substance to escape from one phase into another phase. Fugacity (f) is related to concentration (C) by the fugacity capacity constant Z: $C = Zf$. If Z is low, C will also be low, and compounds present in even low concentrations will readily escape to another environmental compartment. These compartments might include the atmosphere, groundwater, surface waters, river sediments, soils, biota, subsurface strata, and many others. Toxic substances will accumulate in phases where Z is high. The significance of these findings is that Z can be measured and, therefore, the approximate behaviour of compounds in the environment can be predicted.

From previous study in these laboratories, the chemical composition of a number of possible sources of contamination is known. It is proposed to make measurements of the fugacity constant Z for these compounds in aqueous, sorbed, and biotic phases. These measurements will be based on actual contaminant mixtures using river sediments and oil sands as the matrices and mathematical models, estimates will then be made of the distribution, movement, and persistence of these materials in various environmental compartments.

Contractor: Mr. E. Peake and Dr. N. Okazawa, Kananaskis Centre for Environmental Research, University of Calgary

Funding: $50 000.00

Threshold Values for Selected Chemicals Capable of Taste and Odour Tainting in Fish of the Athabasca River

During the recent Suncor hearing, it became evident that more research was required to determine the concentrations of certain compounds associated with the wastewaters of oil sands mining activities that were able to cause fish flesh tainting. This study was designed to determine the taste and odour threshold values of selected chemicals in fish flesh. The compounds selected were representative of certain refining processes in the oil sands area north of Fort McMurray. The levels of the compound tested were related to that in the Athabasca River. The project was designed to provide assistance in the development of tailings pond discharge standards.

Contractor: Dr. Steve Hrudey, Department of Civil Engineering, University of Alberta

Funding: $5 125.00

Soil-Metal Interactions and Associated Analytical Methods - A Literature Review

The objective of the project is to review the international literature regarding analytical methods used to describe the occurrence and behaviour of arsenic, boron, chromium, cobalt, mercury, molybdenum, selenium, and vanadium in soils; and to report on the results of the literature search.

Contractor: Dr. Salim Abboud, Alberta Research Council

Funding: $10 000.00

PUBLICATIONS

Baker, B.L. 1985. Surface water contamination by landfill leachates. Prep. for Research Management Division, Alberta Environment by Kananaskis Centre for Environmental Research, University of Calgary. RMD Report L-90. 28 pp.

Baker, B.L. 1985. Attenuation of pollutants by Alberta soils. Prep. for Research Management Division, Alberta Environment by Kananskis Centre for Environmental Research, University of Calgary. RMD Report L-89. 26 pp.

COMMITTEES

Departmental

Departmental Committee on Acid Deposition (DCAD)

Water Program Planning Committee

Pulp and Paper Mill Effluents Committee

Interagency/Interdepartmental

Alberta Fishways (Alberta Environment, Alberta Energy and Natural Resources, Alberta Transportation, and Environment Canada)

Alberta Watershed Research Program (AWRP)

Applied Aquatic Workshop Committee

Canadian Annual Aquatic Toxicity Workshop Steering Committee

Decommissioning Workshop Committee

Kananaskis Centre Policy Advisory Committee

Panel for Energy Research and Development

Plains Aquatic Research Group

Water Sub-program Committee

ENVIRONMENTAL EMERGENCIES AND RISK ASSESSMENT RESEARCH PROGRAM

The uncontrolled release of environmental pollutants presents a serious concern to the public. The Environmental Emergencies and Risk Assessment Research Program will identify departmental research needs to minimize possible emergency situations and provide a means for identifying, analyzing, interpreting, and evaluating all significant risks within Alberta. The program, which is currently in the developmental stage, will provide scientifically validated strategies for integrated environmental protection.

There were no projects funded under this program in 1985/86.

No publications.

ENVIRONMENTAL INFORMATION RESEARCH PROGRAM

This program is currently being reviewed by the Research Management Division in an effort to reduce the overall number of programs and to integrate the research activity under this program with other divisionally managed programs. Up until its most recent operational year (1983/84), the program included two types of research activities:

1. Public perception research identifying environmental issues of public concern to provide important feedback regarding departmental policies and their effectiveness on public perceptions; and
2. Translation of results from all research areas to produce policy-relevant alternatives so that information gathered through public perception research is made meaningful for decision-makers.

There were no projects funded under this program is 1985/86.

PUBLICATIONS

The following list of publications were omitted from earlier RMD Fiscal Year Reviews.

Gartrell, J.W. 1982. Community as a social collective. In: Energy Resource Communities, G.F. Summers and A. Selvik, eds. Bergen, Norway: MJM Publishing. pp. 199-218.

Gartrell, J.W. 1983. Rapid growth, health and well-being: A comparison of ten communities. Canadian Journal of Community Mental Health, Special Supplement No. 1, Winter, 1983.

Gartrell, J.W. and H. Krahn. 1983. Stability in Alberta hinterland boom-towns. Paper presented at the 6th International Seminar on Marginal Regions, 1981 August 06-21, Bergen/Sognal, Norway.

Gartrell, J.W. and H. Krahn. 1983. Population growth and stability in Alberta hinterland boom-towns. In: Centre-Periphery: Theory and Practice. Sixth International Seminar on Marginal Regions. Bergen/Sognal, Norway. pp. 309-328.

Gartrell, J.W., H. Krahn, and T. Trytten. 1984. Boom-towns: The social consequences of rapid growth. In: Resource communities: A decade of disruption, D.D. Detomasi and J.W. Gartrell, eds. Boulder, Colorado: Westview-Press. pp. 85-100.

Krahn, J. and J.W. Gartrell. 1981. Social mobility in a Canadian single-industry community. Paper presented at the Canadian Sociology and Anthropology Association Meeting, May 1981, Halifax, Nova Scotia.

Krahn, H. and J.W. Gartrell. 1983. Labour market segmentation and social mobility in a Canadian single-industry community. Canadian Review of Sociology and Anthropology 20(3):322-345.

Krahn, H., J.W. Gartrell, and L. Larson. 1981. The quality of family life in a resource community. Canadian Journal of Sociology 6(3):307-324.

COMMITTEES

Departmental

Departmental Committee on Acid Deposition (DCAD)

Interagency/Interdepartmental

Alberta Environmental Research Trust Grants Advisory Committee (AERT-GAC)

Alberta Government/Industry Acid Deposition Research Program (AGIADRP) Medical Diagnostic Review Project Committee

Kananaskis Centre Policy Advisory Committee (University of Calgary)

Statistics Coordinating Committee Support Group (Alberta Bureau of Statistics)

GEOSCIENCE RESEARCH PROGRAM

The Geoscience Research Program was developed to co-ordinate research in the areas of natural resource development and natural hazards such as earthquakes and landslides. Research in geology, geophysics, geotechnical engineering, and soil sciences is covered by this program.

This program is intended to provide scientific information for evaluating and reviewing Alberta Environment's standards, and will assist in establishing long-term policies to ensure that Alberta's natural resources are used in an efficient and responsible manner.

PROJECTS

Turtle Mountain Seismic Velocity Study

This project was designed to determine the seismic velocity structure in and near Turtle Mountain. Accurate and detailed knowledge of seismic velocities in the different geological and structural units and sub-units of Turtle Mountain is necessary to properly interpret the seismic data currently being received by the Turtle Mountain Seismic Array. Carefully timed and located explosives were detonated in 50 foot shotholes located several kilometers from Turtle Mountain. The resulting seismic signals were recorded by at least 24 geophones developed on and near the base of the mountain. Careful analysis of the resulting data yielded the desired velocity values.

Contractor: Dr. E.R. Kanasewich (Department of Physics, University of Alberta)
Funding: $5000.00

Turtle Mountain Seismicity Study: Phase II

The objective of this study was to examine and interpret all microseismic and earthquake activity in the Crowsnest area as recorded by the Turtle Mountain Seismic Array operated by Alberta Environment.

The project involved the examination of all seismic data as recorded by the Turtle Mountain Seismic Array. Events were catalogued, plotted and identified as to the nature and origin of the activity. Naturally occuring microseisms and earthquakes, insofar as data quality allowed, were located and classified as to magnitude and time and spatial distribution.

Contractor: Dr. E.R. Kanasewich (Department of Physics, University of Alberta)
Funding: $6000.00

Photogrammetric Deformation Monitoring of Turtle Mountain

Photogrammetric deformation monitoring technology of the south peak of Turtle Mountain has been developed to a level where sub-centimeter movements could be detected. This project and the following second order levelling phase have contributed to this development and include the establishment of four permanent stations on the peaks in the monitoring area;

and establishing elevations to second order standards on each of the four stations and on selected existing monuments.

The purpose of this survey was to provide a stable reference system to confirm the photogrammetric process.

Contractor: McMurphy-Warne Surveys Alberta Ltd., the Orthoshop

Funding: $10 651.00

Photogrammetric Monitoring of the South Peak of Turtle Mountain: Second Order Levelling

See previous project description.

Contractor: Brown Okamura & Associtesﾠ Ltd. (Lethbridge)

Funding: $3 000.00

Video on Deformation Monitoring of Turtle Mountain

A 10-minute video was produced on the development of deformation monitoring techniques on Turtle Mountain, to be shown in the Canadian Exhibit at the Congress of the International Federation of Surveyors, held in June 1986 in Toronto.

Contractor: Various contractors for script, production, cinematography, picture and sound editing, and translations.

Funding: $20 000.00
$ 5 000.00 (Research Management Division)

COMMITTEES

Interagency/Interdepartmental

Turtle Mountain Study Team (Alberta Environment, Alberta Forestry, Lands and Wildlife, Alberta Disaster Services, Alberta Culture)

RECLAMATION RESEARCH PROGRAM

In the province, land disturbed by large-scale surface mining operations must be returned to equal or better capability. The Reclamation Research Program is designed to identify methods that will make the reclamation process more efficient and effective. Research is centred on:

1. Determining methods of rebuilding productive soils (physically, chemically, and biologically);
2. Identifying changes in the quantity and quality of surface water and groundwater following disturbance and reclamation;
3. Developing native plant species for reclamation;
4. Controlling erosion; and
5. Improving materials-handling operations.

Recommendations arising from the program will be used to refine the government's Development and Reclamation Guidelines.

Reclamation research was co-ordinated within Alberta Environment by the Reclamation Research Co-ordinating Committee until January 1986. In January, this responsibility was transferred to the Reclamation Program Planning Committee, chaired by the Research Management Division. The Committee developed a prioritized list of research needs for the 1986/87 fiscal year. Research Management Division also assumes managerial and administrative responsibilities for reclamation research in association with the interdepartmental Reclamation Research Technical Advisory Committee (RRTAC). In 1985/86, RRTAC committed approximately $1.2 million to a Reclamation Research Program. Funding for RRTAC projects is through the Heritage Savings Trust Fund (HSTF).

Program direction is determined by an interdepartmental committee with members from the Alberta government departments of Agriculture, Energy, Forestry, Lands and Wildlife, and Environment, and the Alberta Research Council. Direction of projects and sub-programs in three biophysical regions (Plains, Mountains and Foothills, and Northeast Alberta) is co-ordinated by government/industry committees.

PROJECTS

Alberta Oil Sands Environmental Research Program (AOSERP) Map Catalogue

A series of maps were generated over the 10-year span of AOSERP between 1975 and 1985. These maps were catalogued and a computer listing of map types was created.

Contractor: Anne Avramenko
Funding: $2 500.00

Assessment of Reclamation Potential and Hydrological Impact of Large-Scale Surface Mining in Plains Areas of Alberta

The main objective of this project is to develop a thorough understanding of the materials present and the hydrologic and geologic processes acting within the landscape so that the results of various surface landform and materials placement designs can be assessed with reference to potential land use options following mining.

Contractor: Dr. S.R. Moran, Natural Resources Division, Alberta Research Council
Funding: $649 254.00 (Alberta Heritage Savings Trust Fund)

Battle River Soil Reconstruction Project

The objectives of this study are:

1. To determine the required depth of soil placement over sodic mine spoil to ensure that mined land, particularly in the Battle River Coal Field, meets reclamation objectives;
2. To develop methods of sustaining re-established capability, with emphasis on controlling salt movement from mine spoil into the reconstructed root zone; and
3. To develop treatments that will minimize soil quantities needed to restore the original capability of the land.

Contractor: Mr. L.A. Leskiw, Pedology Consultants
Funding: $140 000.00 (Alberta Heritage Savings Trust Fund)

Bottom Ash Amendment of Orphaned Sodic Soil

This study is designed to:

1. Determine the best rate and method of bottom ash application to sodic spoil as related to crop yield and trafficability;
2. Compare application rate and method effects on physical and chemical soil parameters;
3. Monitor changes in ash and spoil over time; and
4. Compare growth between areas with and without bottom ash.

Contractor: Ms. S. Landsburg
Funding: $11 554.00 for three projects listed below (Alberta Heritage Savings Trust Fund)

Bottom Ash Plots: Samples

This subproject consists of a number of various soil and plant sample analyses. It falls under the direction of Ms. S. Landsburg as a portion of her project "Bottom Ash Amendment of Orphaned Sodic Soils."

Contractor: Mr. J. Crepin, Norwest Soil Research Inc.
Funding: $8 000.00 (Alberta Heritage Savings Trust Fund)

Bottom Ash Plots: Harvesting

This subproject consists of the harvesting of forage crops from 42 bottom ash plots. It falls under the direction of Ms. S. Landsburg as a portion of her project "Bottom Ash Amendment of Orphaned Sodic Soils."

Contractor: Mr. A. Twardy, Pedology Consultants
Funding: $2 000.00 (Alberta Heritage Savings Trust Fund)

Bottom Ash Plots: Computing

This project consisted of data entry and computer processing of research data from the bottom ash plots.

Contractor: Mr. Toby Entz
Funding: $1 554.00 (Alberta Heritage Savings Trust Fund)

Highvale Soil Reconstruction Project

The objectives of this study are:

1. To determine the required depth of soil replacement over sodic mine spoil to ensure that mined land, particularly in the Highvale Mine Permit Area, meets reclamation objectives;
2. To assess the sustainability of re-established capability with emphasis on monitoring salt movement from mine spoil into the reconstructed root zone; and
3. To examine the effects of slope aspect and slope steepness on water movement, salt movement, and productivity.

Contractor: Mr. L.A. Panek, Monenco Consultants Ltd.
Funding: $132 183.00 (Alberta Heritage Savings Trust Fund)

Oil Sands Tailings Soil Reconstruction Project

The objective of this project is to identify methods of constructing soils from tailings sand, peat, and clay materials that will:

1. Support desired initial vegetation cover; and
2. Evolve over time and in response to the forces of pedogenesis in the oil sands region into a soil capable of supporting a maintenance-free forest at the desired level of productivity.

Contractor: Mr. H.E. Martens, Hardy Associates (1978) Limited
Funding: 105 000.00 ($52 500.00 RRTAC; $52 500.00 Syncrude and Suncor)

Reinstatement of Mycorrhizal Potential in Reconstructed Soils

Mycorrhizal fungi are very important to the nutrition of trees. This project will determine the survival and inoculum potential of mycorrhizal fungi in undisturbed and reconstructed soil to be used in oil sands tailings reclamation. Also, fungal species will be selected for use in jack pine inoculation programs and mycorrhizal development will be monitored in field trials.

Contractor: Dr. D. Parkinson, Kananaskis Centre for Environmental Research, University of Calgary
Funding: $79 975.00 (Alberta Heritage Savings Trust Fund)

Soil Reconstruction in Mountains and Foothills - Revision of Final Report

The primary aim of the project is to assemble available information to enable operational reclamation decisions to be made, where possible, to meet three reclamation objectives:

1. Tree growth (forestry);
2. Shrub growth (wildlife); and
3. Herbaceous cover (erosion control).

The review will also determine the information gaps and recommend needed research.

Given that operational costs of reclamation are often very high, the review will attempt to determine how to undertake reclamation at the lowest possible cost.

Contractor: Mr. Len Knapik, Pedocan Land Evaluation Ltd.
Funding: $12 000.00 ($6000.00 RRTAC; $6000.00 Coal Association of Canada).

Disposal of Wastes from Drilling Systems on the Public and Private Lands of Alberta

By reviewing existing literature for Alberta, Saskatchewan, British Columbia, nearby regions and other pertinent sources, the aim of this project is to determine the physical and chemical problems that are associated with the disposal of the liquid, treatable solids and untreatable solids portions of drilling wastes in Alberta.

Contractor: Mr. L.A. Leskiw, Pedology Consultants
Funding: 30 000.00 (Alberta Heritage Savings Trust Fund)

Waste Dump Design for Erosion Control

The study follows up work begun in 1982 for RRTAC related to the design of mountain/foothills coal mine waste dumps, where the slopes that were being achieved on free and resloped dumps were defined. The objectives of this erosion study are to examine surface stability and erosion control as a function of dump design (i.e., terrace height and width, slope length and angle). The knowledge generated will be useful in determining practical guidelines for waste dump reclamation and design.

Contractor: Mr. R.G. Chopiuk, Coal Mining Research Company
Funding: $50 000.00 (Alberta Heritage Savings Trust Fund)

PUBLICATIONS

Dusseault, M.B., J.D. Scott, and S.R. Moran. 1985. Smectitic clays and post-reclamation differential subsidence of strip mined areas. Applied Clay Science 1:163-172.

Schwartz, F.W. and A.S. Crowe. 1985. Simulation of changes in groundwater levels associated with strip mining. Geological Society of America Bulletin 96:253-262.

Ziemkiewicz, P.F., ed. 1985. Proceedings on revegetation methods for Alberta's mountains and foothills. Alberta Land Conservation and Reclamation Council, Reclamation Research Technical Advisory Committee. Report No. RRTAC 85-1.

COMMITTEES

Departmental

Acid Deposition Program Planning Committee

Departmental Committee on Acid Deposition

Geoscience Program Planning Committee

Reclamation Program Planning Committee

Reclamation Research Coordinating Committee

Interagency/Interdepartmental

Mountains and Foothills Reclamation Research Program Steering Committee

Mountains and Foothills Reclamation Research Program Revegetation Subcommittee

Oil Sands Reclamation Research Program Steering Committee

Oil Sands Reclamation Research Program Technical Committee

Plains Coal Reclamation Research Program Steering Committee

Plains Coal Reclamation Research Program Soil/Crop Subcommittee

Soil pH Technical Committee

WATER RESOURCES RESEARCH PROGRAM

The Water Resources Research Program is designed to study environmental trends and to evaluate conditions in groundwater and surface water. Results of the research will provide scientific support for developing guidelines and regulations, and input into the management decision making process.

Of significance are the jointly funded research projects with the Alberta Research Council: the Hydrogeology of the Cold Lake Area, and the Cooperative Program in Surface Water Engineering.

PROJECTS

Hydrogeology of the Cold Lake Study Area

The first phases of this study have shown that the regional groundwater flow regime has a northeasterly trend. Therefore, the study area was expanded to the east to include adjacent areas of Saskatchewan, and to the south to incorporate major operations in that area as well. The hydrogeology was evaluated and modelling of deepwell injection was initiated to assess potential effects on the environment.

Contractor:	Dr. B. Hitchon, Basin Analysis Group Alberta Research Council
Funding:	$200 000.00

Cooperative Program in Surface Water Engineering

The program encompasses research projects in fluvial mechanics of river engineering, erosion and scouring, sediment yield studies, freeze-up and break-up of rivers. These projects are designed to investigate long term as well as randomly occurring phenomena. They are identified on the basis of their impact on public safety, protection of property, or a defined need for information to be used for the design of hydraulic structures. Information derived from the program is also used for enforcement of the Water Resources Act and Regulations.

The five projects in this program address research priorities identified by the River Engineering Branch, Hydrology Branch, and Flow Forecast Centre of the Technical Services Division of Alberta Environment. These priorities are:

1. Scour surveys and river bed processes at stream crossings;
2. River bank protection;
3. Study of cohesive materials;
4. Gauge surveys and river data base development; and
5. Ice hydraulics: freeze-up and break-up processes of streams.

Contractor:	Dr. B. Shields or R.A. Harrington, Civil Engineering Department, Alberta Research Council
Funding:	$150 000.00 (Research Management Division)

Flatland Hydrology Simulation Model

In this graduate student project, a model is being developed that will include a spatially varied soil moisture budget for a flatland watershed.

The concepts of potential and actual contributing areas will be used to determine depression storage losses, thereby allowing more accurate determination of the excess rainfall that will convert into runoff.

Contractor:	Dr. J.P. Verschuren, Department of Civil Engineering, University of Alberta
Funding:	$15 000.00

Control of Irrigation Return Flows in Southern Alberta

This project is studying the sensitivity of irrigation return flow rates to several irrigation canal design and operation parameters. A computer model, designed by the contractor is used to investigate factors such as: shape, slope, condition, design capacity of canals, number of depth control structures, seepage rates, flow rates, operation and type of control structures, and number of delivery points.

Contractor:	Dr. D. Manz, Department of Civil Engineering, University of Alberta
Funding:	$21 000.00

Monitoring Groundwater Contribution to Water and Nutrient Budgets of Aquatic Systems in Alberta

The purpose of this study is to develop methods and strategies for measuring groundwater-lake flux. In particular, the use of inexpensive, in situ methods (seepage meters and mini piezometers) are tested.

Also techniques are developed for lake managers to quantify seepage most efficiently.

Contractor:	Dr. E. Prepas and Mr. R. Shaw, Department of Zoology, University of Alberta
Funding:	$20 000.00

Snowmelt Infiltration into Frozen Prairie Soils

The objective of this study is the development of a mechanism to predict the amounts of snowmelt and their effects on soil moisture and surface runoff in the prairie regions. The first phases have produced a computer modelling capability of snowmelt infiltration into frozen prairie soils to predict soil moisture conditions in early spring. This phase is investigating the effects of snowmelt on surface runoff hydrographs of small and intermediate prairie watersheds.

Contractor: Dr. D.M. Gray, Division of Hydrology, University of Saskatchewan
Funding: $20 000.00

WATER TREATMENT AND WASTE MANAGEMENT RESEARCH PROGRAM

The objectives of the program are tied to Departmental policy and to concerns of the public and the scientific community. In general, the program is designed to provide information on, and solutions to, priority issues identified at public hearings, workshops, or by the department.

The program objectives can be described in broad terms as follows:

1. To scope and prioritize water treatment and waste management research areas;
2. To provide a mechanism for co-ordination of all water treatment and waste management research in Alberta;
3. To encourage the development of water treatment and waste management research expertise both within the government and in the province as a whole; and
4. To encourage cross-media and multi-disciplinary approaches to water treatment and waste management research.

Projects undertaken in the 1985/86 FY were:

1. RMD 85-19: Enhanced Microbial Decomposition of Hydrocarbons in the Unsaturated Zone - A Feasibility Study;
2. RMD 86-11C: A study to Identify Inventory Control Procedures at Commercial Service Stations in the Edmonton Area;
3. RMD 83-46: Methodology Development for *Giardia* Detection;
4. RMD 85-38: Departmental Overview of Pulping Technology and Wastewater Quality/Treatment;
5. RMD 82-60: Pilot Studies in the Use of Ozone for Domestic Water Treatment;
6. RMD 85-11B: Preliminary Investigation into the Decommissioning of Phosphogypsum Tailings Ponds in Alberta;
7. RMD 85-12A: Review of Oil Sands Tailings Pond Contaminants with Fish Tainting Potential;
8. RMD 85-07: Water Treatment Evaluating for *Giardia* Cyst Reduction.
9. RMD 85-11A: Determination and Quantification of Organic Contaminants in a Decommissioned Railyard;

10. RMD 85-11D: Computer Entry and Analysis of Data on Contaminants in a Decommissioned Railyard; and
11. RMD 85-14: Aquatic Fate of Fish Tainting Compounds in the Athabasca River.

PROJECTS

Enhanced Microbial Decomposition of Hydrocarbons in the Unsaturated Zone - A Feasibility Study

Hydrocarbon contamination of the unsaturated zone has been ameliorated in the past by removing the available free product from the water table surface and allowing natural processes to remove the residual material over time. Because of the quantity of residual material and slow decomposition rates, groundwater quality is only improved slowly by relying on natural processes.

Techniques for removing residual hydrocarbon compounds using biodegradation have been developed elsewhere and have been shown to be successful in a number of cases. These techniques have not been applied extensively in the Alberta context. Issues such as soil types, temperatures, and native microorganisms were evaluated to assess the feasibility of this technique.

This technology would have important application to hydrocarbon spill locations, abandoned oil well sites, and site decommissioning. The technology appears proven but must be assessed under Alberta oil and climate conditions.

Final report in preparation.

Contractor: Stanley Associates Engineering Ltd.
Funding: $15 000.00

A study to Identify Inventory Control Procedures at Commercial Service Stations in the Edmonton Area

Over the past six years in Alberta there have been an increasing number of reports of gasoline leakage from underground storage tanks. Lost gasoline has collected in underground utility corridors and on occasion has contaminated local potable groundwater supplies. Gasoline vapours have been identified in structures such as sewage lift stations, commercial office buildings, apartments and private residences where these vapours have created potentially explosive situations. The uncertainty with regards to the role small service stations play in the decommissioning problem was identified at a 1986 decommissioning workshop in Calgary.

Inventory control of gasoline in storage is the primary method of evaluating the operating status of an underground tank. Under Section 219(1) of the Alberta Fire Code, the service station operator must complete a daily inventory check on each tank. This requirement is fairly standard across Canada, however, based on experience and on discussions at a recent national workshop addressing underground storage problems, it is apparent that these inventory records are not commonly being properly maintained. The purpose of this research project was to identify the extent to which similar problems exist in Alberta. A survey of service station operators was undertaken in order to evaluate the degree of compliance with the Alberta Fire Code. A questionnaire was prepared by representatives of Alberta Environment with assistance from the Fire Commissioner's Office. The questionnaire was directed at inventory control procedures and included an evaluation of the available records. The project concentrated on the Edmonton area.

Final report in preparation.

Contractor: Sereda, Marsh and Associates
Funding: $8 000.00

Methodology Development for Giardia Analysis

Recent work has shown that the levels of infection for Giardia in wild domestic animals in Alberta averages about 10%. Many of these animals have the potential to introduce cysts, that may be pathogenic to humans, into water supplies. Good progress has been made in the detection and recovery of cysts in water supplies, but the human pathogenicity of such cysts remains undetermined. This project is directed towards applying existing identification methods for Giardia isolated from water supplies, as samples become available, and developing new methods of identification. If successful, the results from this project will provide the information and methodology necessary to respond definitively to suspected waterborne outbreaks of giardiasis by confirming the presence of cysts.

Contractor: Dr. P.M. Wallis, Kananaskis Centre for Environmental Research
Funding: $30 000.00

Departmental Overview of Pulping Technology and Wastewater Quality/Treatment

A research program is being developed by RMD to enable the Department to assess applications for the possible siting of TMP/CMP/CTMP pulp mills. This is in recognition that several timber areas will eventually be developed and that the most likely pulp and paper technologies to be employed would be TMP/CMP/CTMP. However, little information is available on these technologies and their effluents relative to chemical based pulp mills and although the effluents are purported to be more acceptable than the common chemical variety, major concerns exist relative to impacts on drinking water treatment plants downstream. RMD has conducted a literature review and has assembled information on the indicated technologies.

Final report in preparation.

Contractor: Ian Mackenzie and Jack Marsh, Alberta Environment
Funding: $6 000.00

Pilot Studies in the Use of Ozone for Domestic Water Treatment

This project was designed to investigate the feasibility of using ozone in the treatment of domestic water as an alternative to chlorination. The study involved the construction and operation of a pilot plant at the City of Calgary Glenmore Water Treatment Facility. The pilot plant was operated for one full year. During the three year operation, particular attention was paid to contractor design effects, reaction kinetics, reaction products, and microbial inactivation.

Contractor: Mr. G.A. Irvine, University of Calgary
Funding: $40 000.00

Preliminary Investigation into the Decommissioning of Phosphogypsum Tailings Ponds in Alberta

The environmental concerns associated with phosphogypsum tailings ponds challenge the decommissioning process through contamination of land by large volumes of by-product gypsum, influencing options for a suitable end use. Several Alberta phosphate fertilizer plants contain tailings ponds over

50 hectares in size. With the knowledge that these areas could revert to an alternate use in the future, a procedure for addressing the environmental concerns is necessary. A multi-government study (RMD 85-30) investigating radon emanation from phosphogypsum tailings with a view to developing guidelines will be underway in August 1986. The objective of this study (RMD 85-11B) is to obtain background information on the environmental aspects of phosphogypsum ponds, and (2) recommend a preliminary plan for a site assessment and investigation of an Alberta phosphogypsum pond.

Final report in preparation.

Contractor: Glen Norlander, University of Calgary
Funding: $5 000.00

Review of Oil Sands Tailings Pond Contaminants with Fish Tainting Potential

Tailings pond discharge criteria are now being considered and it is imperative that an identification of compounds of environmental concern associated with surface mining and upgrading activities be undertaken. Of particular relevance are those compounds related to fish flesh tainting and tastes and odours in drinking water. In addition, the processes producing these compounds and the probable treatment performance in reducing them must be evaluated. This study: (1) summarized research on the environmental significance of specific contaminants from oil sands operation; (2) listed compounds and contaminants associated with fish flesh tainting and drinking water and considered their bioconcentration potential; (3) reviewed monitoring procedures with consideration of the practicality of including specific compounds for monitoring guidelines; (4) listed likely process sources and possible in-plant measures to control contaminants at source; and (5) summarized treatment processes likely to remove these contaminants and their expected removal performance.

Final report in preparation.

Contractor: Dr. Steve Hrudey, Steve Hrudey and Associates Ltd.
Funding: $6 000.00

Water Treatment Evaluations for Giardia Cyst Reduction

This project is designed to continue the investigation of the occurence and survival of human infective *Giardia* cysts in water using the mobile experimental water treatment plant. This work will lead to the formulation of recommendations for minimum water treatment standards in Alberta for *Giardia* cyst removal and/or inactivation. Previous research has shown that it is possible to remove cysts from drinking water using conventional methods but that operating standards must be rigorously adhered to. This study is being undertaken in close co-operation with AEC Vegreville, using their mobile water treatment facility.

Contractor:	Dr. P.M. Wallis, Kananaskis Centre for Environmental Research
Funding:	$60 000.00

Determination and Quantification of Organic Contaminants in a Decommissioned Railyard

Environment concerns exist related to decommissioning of railyards in Lethbridge and possibly Edmonton. One major problem is the lack of information on types of contaminants present in railyard settings. A study was initiated by Earth Sciences Division, Technical Development Branch, Lethbridge to address this issue. The objective of the present study is to determine types and amounts of organic compounds occurring in the decommissioned Lethbridge railyard.

Contractor:	Enviro-Test Laboratories
Funding:	$9 000.00

Computer Entry and Analysis of Data on Contaminants in a Decommissioned Railyard

This project will provide data analysis service for the information collected in the ESD study.

Contractor:	Mr. Toby Entz
Funding:	$1 000.00

Aquatic Fate of Fish Tainting Compounds in the Athabasca River

A water management approach for setting ambient surface water objectives and effluent standards for oil sands mining and upgrading activities is discussed. The review examines the relationship between hydrocarbons that are present naturally or introduced from mining activities and their potential for bioaccumulation and tainting of a commercial fishery.

Information from an incomplete data base suggests that certain constituents in oil sands effluent, such as aromatic and aliphathic compounds, including some with tainting potential, are more likely to reflect the composition of upgraded-synthetic crude than raw bitumen. The raw bitumen is deficient in water-soluble components, saturated hydrocarbons, and low molecular weight aromatic compounds. Low molecular weight compounds such as alkylated naphthalenes, benzothiophenes and dibenzothiophenes, and naphthenic acids may be present in oil sands wastewater and can taint fish.

Contractor: HydroQual Consultants Inc. and Dominion Ecological Consulting Ltd.
Funding: $29 000.00

PUBLICATIONS

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McClure, S. and I.B. Mackenzie. 1987. A regulatory agency's experience with *Giardia*. Presented at the Calgary *Giardia* Conference. 1987 February 23-25, Calgary, Alberta.

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Wallis, P.M. In prep. *Giardia* research. Prep. for Research Management Division, Alberta Environment by Kananaskis Centre for Environmental Research, University of Calgary.

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COMMITTEES

Departmental

Athabasca Water Quality Technical Planning Committee

Pulp Mill Effluent Steering Committee

Water Treatment and Waste Management Program Planning Committee

Interagency/Interdepartmental

Federal-Provincial Phosphogypsum Waste Management Committee

Giardia Workshop Steering Committee

Industrial Site Reclamation and Decommissioning Committee

Oil Sands Tailings Pond Steering Committee